

TMS Performance Monitoring, Evaluation, & Reporting

University of Virginia
&
SAIC

Presentation Outline

- ∅ Subject overview
- ∅ Performance measures
- ∅ Performance measurement program
- ∅ Data
- ∅ Performance monitoring, evaluation, and reporting
- ∅ Handbook information

Transportation Management Systems

- ∅ The deployed form of ITS, along with human resource contribution, toward transportation management
- ∅ Includes computer hardware, software, communications, surveillance technology
- ∅ TMC is a physical facility that houses central equipment, software, and personnel that operate TMS

Performance Monitoring, Evaluation, & Reporting

- ∅ Monitoring is ongoing internal process where system conditions are examined through collected data
- ∅ Evaluation is process where collected data is analyzed and compared to set benchmarks.
- ∅ Reporting provides the results of the evaluation for the stakeholders.

Performance Measures

- ∅ Provide quantifiable indicators of program effectiveness and efficiency
- ∅ Help to determine progress toward specific program goals and objectives
- ∅ Help to determine priority projects, goal/objective refinements, and fund allocation

Performance Measure Types

∅ Input

- n Supply of resources

∅ Output

- n Delivery of transportation programs, projects, and services

∅ Outcome

- n Degree to which transportation system meets policy goals and objectives

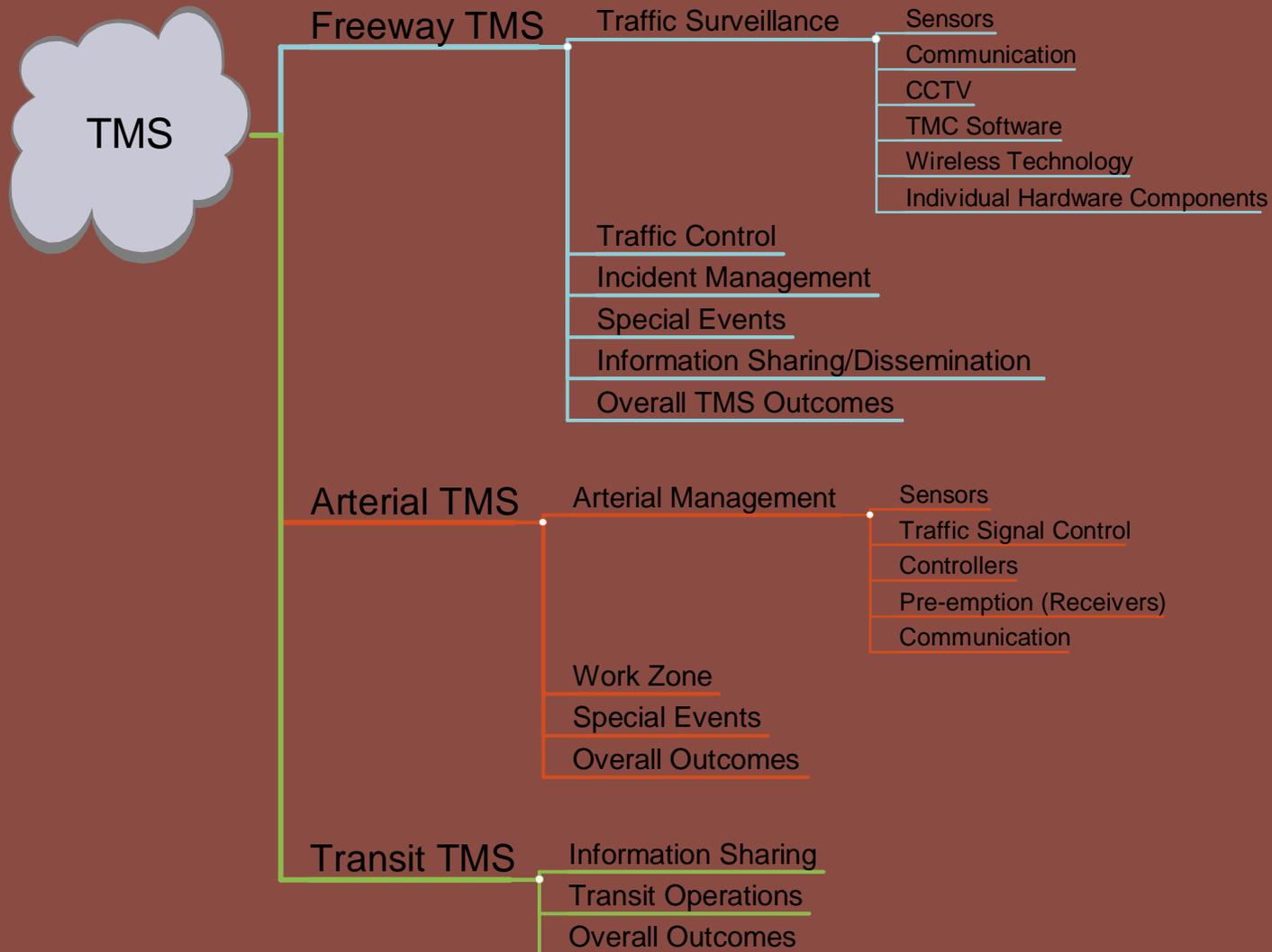
Performance Measure Types

<i>Measure Type</i>	Traditional Capacity	Maintenance and Operations Oriented
Input	Capital projects budget	Person-hours of incident response patrols
Output	Miles of roadway built	Response time to incidents
Outcome	Reduced miles of congestion	Change in incident-related delay

Criteria for Defining Performance Measures

- ∅ Purpose
- ∅ Validity
- ∅ Precision
- ∅ Accuracy
- ∅ Cost-effectiveness

TMS/TMC Functions



Freeway TMS Performance Measures

∅ Incident Management – General Measures

Metric	Type	Supplementary Notes	Calculation
Number of incidents, by severity (e.g., fatal, injury), by type (e.g., crash, stalled vehicle)	external	n/a	n/a
Person hours working for TMS/TMC incident management system	input	Both infield and TMC	No. People x working hours per person
Number of responded crashes versus total number of crashes	output	Responded crashes are crashes responded by state safety patrol or freeway incident response team	No. of responded crashes over total no. of crashes reported
Response time to incidents	output	n/a	n/a

Performance Measurement Program

- ∅ Performance measurement
 - n Use of quantifiable indicators to determine progress made toward agency goals and objectives
- ∅ Program is organized set of measures that combine to quantify and evaluate TMS goals and objectives

Performance Measurement Program Benefits

- ∅ Accountability
- ∅ Efficiency
- ∅ Effectiveness
- ∅ Communications
- ∅ Clarity
- ∅ Improvement

Establishing Performance Measurement Program

∅ Key steps

- n Identify the vision, goals, and objectives of the agency
- n Identify intended uses and audiences
- n Develop TMS performance measures and relate to respective programs.
- n Identify performance benchmarks.
- n Collect complete, accurate, and consistent data
- n Analyze and evaluate data
- n Report data to stakeholders
- n Identify areas for improvement/change and report to stakeholders

Denver Performance Measurement Program

- ∅ Regional Transportation District established in 1969
- ∅ 3-tiered performance measurement program
 - n Service Standards
 - n Quarterly Progress Report
 - n Annual Report
- ∅ Measures reviewed using established standards
- ∅ Collect economic and customer satisfaction measures

Performance Measurement & Data

- ∅ Data is important aspect of performance measurement program
 - n Quantity
 - n Quality
 - n Coverage
- ∅ Without “good” data, performance measurement program cannot be effective

Data

- ∅ Success of performance measurement plan relies heavily on quality of data
- ∅ Data requirements must be defined
- ∅ Requirements specify the types of data needed for an application, domain, or component

Data Requirement Issues

- ∅ Multiple concurrent incidents
- ∅ Local economy
- ∅ Data should be
 - n Relevant
 - n Timely
 - n Cost-effective
- ∅ Sensor coverage

Data Categories

- ∅ Facility use and performance
 - n Determine if TMS is operating at full effectiveness
- ∅ Staff activities and resource use
 - n Measure the efficient use of agency resources
- ∅ Events and incidents that affect normal traffic conditions

Data Collection

- ∅ Data obtained from 3 sources
 - n Data archives
 - n Modeling/estimation
 - n Manual/automatic data collection

Data Archiving

- ∅ Helps to make long-term evaluation possible with regard to these categories.
- ∅ Reasons to archive:
 - n Greater and more accurate data
 - n Cost-effective
 - n Cheaper than manual collection
 - n Adheres to current business practices

Data Collection/Archiving Issues

- ∅ Availability
- ∅ Completeness
- ∅ Coverage
- ∅ Quality
- ∅ Standards
- ∅ Reliability
- ∅ Variability

Data Collection/Archiving Issues (Cont'd)

- ∅ Aggregation level
- ∅ Experimental design
- ∅ Storage
- ∅ Metadata
- ∅ Institutional/data sharing

Data Archiving Best Practice

∅ PeMS

- n Freeway performance management system created by Caltrans and UC-Berkeley
- n Gathers raw, real-time freeway data from participating districts
- n Established process for processing data
- n <http://transacct.eecs.berkeley.edu>

Performance Monitoring

- ∅ Using performance measurement to visualize system status
- ∅ Immediate decisions based this information
- ∅ Long-term monitoring can assist with decision-making
 - n Maintenance
 - n Future deployment

Performance Monitoring Levels

- ∅ System operators typically focus on day-to-day operations of one corridor or roadway
- ∅ Supervisors generally focus on several corridors or entire region
- ∅ Managers generally focus on entire TMS at high level with daily/weekly reports

Monitoring Example

California Home Governor's Site Monday, May

Welcome to California

TMC Home | Cameras | Real-Time Map | Lane Closures | Problem Areas | Border Info | Incident Report | Transportation

Caltrans - District 11 Map

San Diego Freeway Speeds:

- 1 - 35 mph
- 36 - 50 mph
- 51 + mph
- Future Activation
- Future Construction

5 NORTH--May-16-2005--10:14 AM

LOCATION	SPEED
N/O 163	58 mph
Hawthorn St	57 mph
India St	61 mph
San Diego Ave	62 mph
Washington St	62 mph
S/O Old Town Ave	67 mph
Old Town Ave / Moore St	63 mph
S/O 8	62 mph
8 WB Connector	50 mph
Sea World Dr	51 mph
S/O Clairemont Dr	69 mph
Clairemont Dr	59 mph
Mission Bay Dr	59 mph
La Jolla Village Dr	72 mph
Carmel Valley Rd	69 mph

<http://www.dot.ca.gov/dist11/d11tmc/sdmap/mapmain.html>

Performance Evaluation

- ∅ Analysis of data about the TMS
- ∅ Results compared to benchmark measures
- ∅ Used to determine effectiveness of strategies, policies, systems, etc.
- ∅ Helps identify areas to improve and justify the need for additional resources

Performance Evaluation

- ∅ Allows for the following:
 - n Determination of actual improvement in performance
 - n Identification of problems that result in inefficiencies
 - n Analysis and prioritization of alternative solutions
 - n Estimation of the benefits and costs of TMS

Evaluation Techniques

- ∅ Prior to selecting a tool to evaluate the TMS, agencies need to consider the following:
 - n Analysis context (planning, design, ops, etc.)
 - n Geographic scope (corridor, region, etc.)
 - n Capability of modeling facilities (freeway, HOV lanes, etc.)
 - n Ability to analyze various modes

Evaluation Techniques (Cont'd)

∅ Also must consider

- n Ability to analyze different management strategies (ramp metering, signal coordination, etc.)
- n Ability to estimate traveler response to management strategies (route diversion, mode shift, etc.)
- n Ability to output direct performance measures (safety, efficiency, etc.)
- n Tool/cost effectiveness

Before-and-After Evaluation

- ∅ Most common method to evaluate TMS effectiveness
- ∅ Studies effects of particular management strategy by studying performance measurement results from before and after the implementation

Before-and-After Evaluation Issues

- ∅ Difficulty in distinguishing effects of one improvement when multiple ones were made at once
- ∅ Time needed for drivers to adjust to change
- ∅ Time-related factors
- ∅ Regression to the mean

Best Practice

- ∅ Before-and-after study of Phase I of I-10/I-17 FMS in Phoenix area
- ∅ Studied several MOEs for 57 km of freeway fitted with ramp meters, VMS, loop detectors, CCTV cameras
- ∅ 2-6% travel time improvement along seven-mile stretch with ramp meters

Performance Reporting

- ∅ Allows for communication with stakeholders about system performance
- ∅ Helps in decision-making process
- ∅ Allows for tracking of TMS progress
- ∅ Creates sense of accountability

Reporting Trends

- ∅ Using the media
- ∅ Daily/weekly intranet postings
- ∅ Quarterly/monthly public reports on the Internet
- ∅ Formal biannual/annual reports for government/business officials
- ∅ “Notebooks” keep key decision-makers up to date on agency performance/goals

Reporting Best Practice

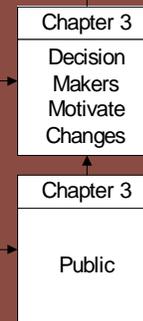
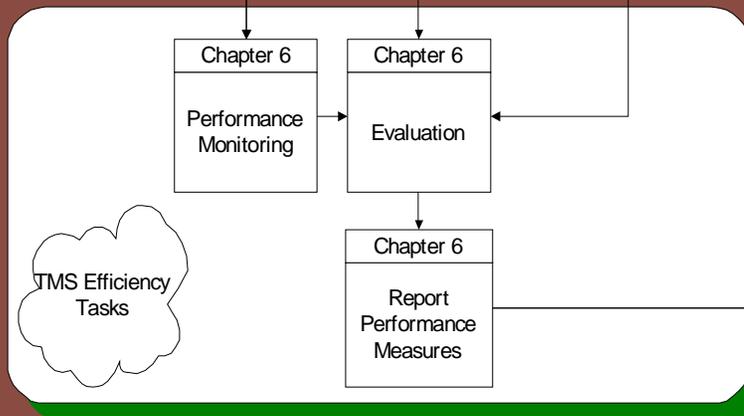
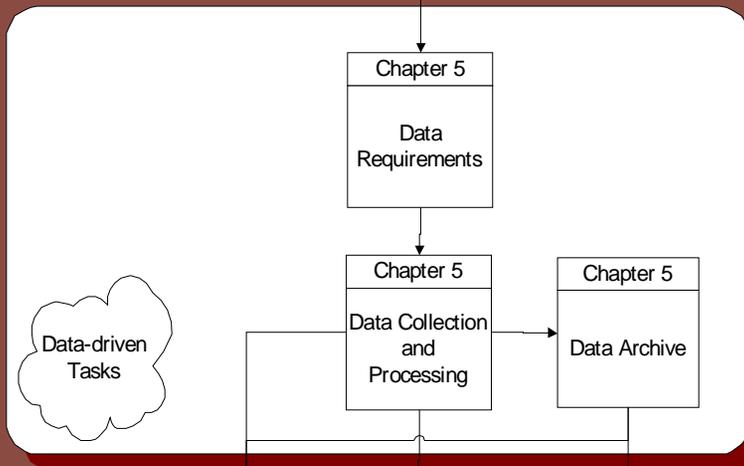
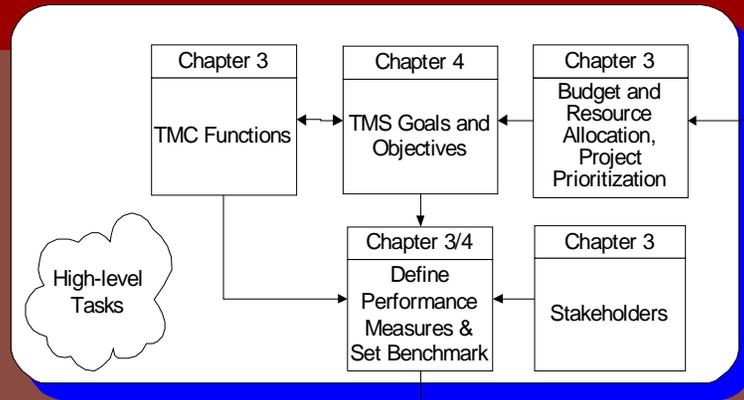
- ∅ WSDOT's "Gray Notebook"
- ∅ Explains agency's planning process and rationale behind decision-making
- ∅ Assesses statewide conditions
- ∅ Tracks assortment of reliability and effectiveness measures for routine review
- ∅ Has become important source for state legislators and other agency stakeholders

Handbook Overview

- ∅ Handbook serves as a technical reference on performance monitoring, evaluation, and reporting
- ∅ Provides ways for planning, implementing, and sustaining a performance measurement program
- ∅ Discusses issues related to data collection and archiving

Handbook Overview (Cont'd)

- ∅ Intended audience include representatives of
 - n State DOTs
 - n MPOs
 - n Transit agencies
 - n Enforcement agencies
- ∅ Intended audience is also anyone with role in TMS/TMC performance monitoring, evaluation, and reporting



Handbook At-A-Glance

- ∅ **Chapter 1 – Introduction.** Defines the background, purpose, and scope of the handbook and the intended audience.
- ∅ **Chapter 2 – Overview of TMS Performance Monitoring, Evaluation, and Reporting.** Provides a high level overview of TMS performance monitoring, evaluation, and reporting and how they relate to TMSs.
- ∅ **Chapter 3 – Performance Measurement Program.** Discusses the purpose and importance of, and need for a TMS performance measurement program.

Handbook At-A-Glance

- ∅ **Chapter 4 – Agency Goals and Performance Measures.** Presents typical performance measurement goals of TMS-related agencies. Also provides high-level performance measures by TMS functions and calculation methods of such performance measures.
- ∅ **Chapter 5 – Data Requirements, Collection and Archiving.** Provides performance measure data requirements and best practices for data collection, evaluation, and reporting.

Handbook At-A-Glance (cont'd)

- ∅ **Chapter 6 – Performance Monitoring, Evaluation and Reporting.** Explains various monitoring and evaluation methodologies and processes related to TMS performance. Discusses recommended reporting techniques, formats, and frequencies for reporting TMS performance.
- ∅ **Chapter 7 – Self- Assessment.** A checklist of questions drawn from case studies. Can be used by TMCs to assess the status and performance of the TMS. Also includes some best practice examples from selected agencies.
- ∅ **Appendix A – Survey Questionnaire and Results**
- ∅ **Appendix B – Contact List of Traffic Management Centers**

Other Subject Information

- ∅ Fact sheet
- ∅ FAQ
- ∅ Tri-fold brochure
- ∅ Primer
- ∅ Available at
<http://tmcdfs.ops.fhwa.dot.gov/Projects.htm>

